Free-radical Research in State-governed Data-intensive Systems

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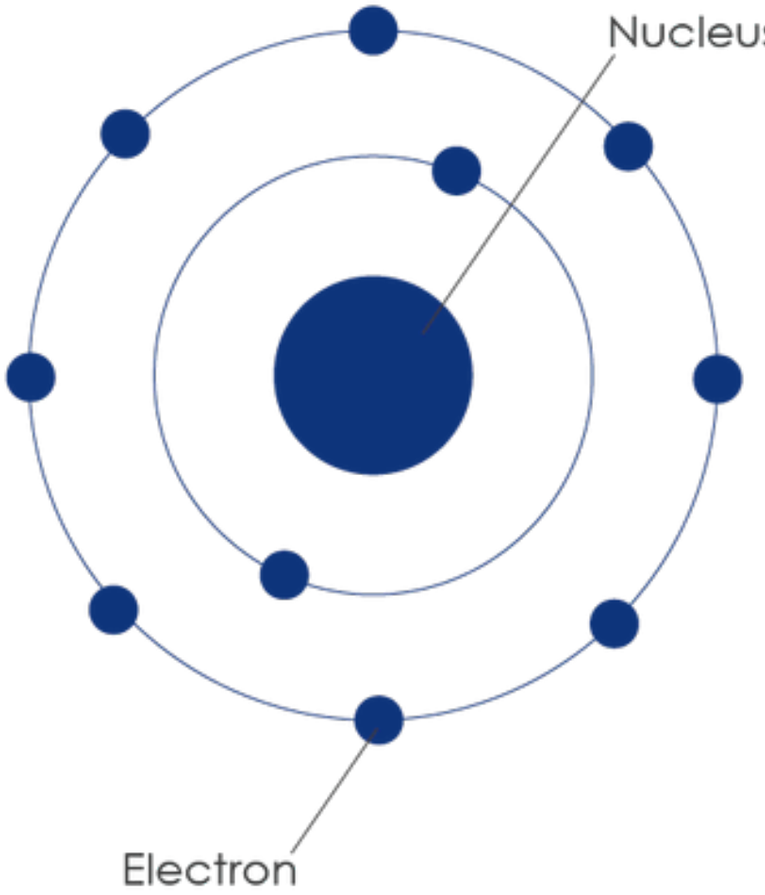
Outline

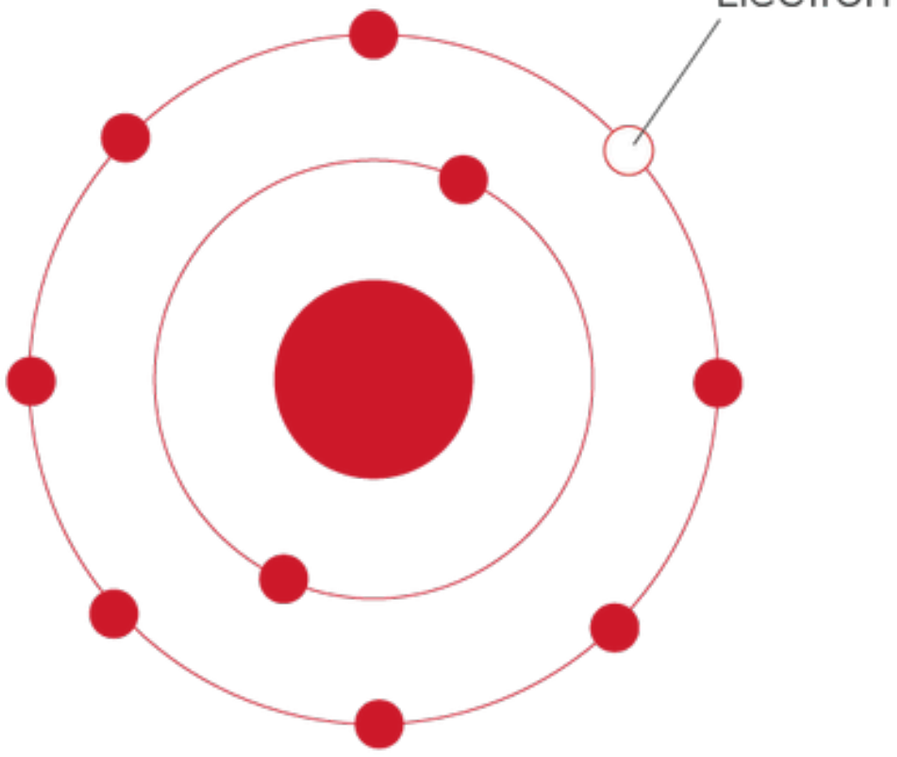
- **What is free-radical research?**
- Increasing screening attendance with FightHPV
- Visualizing patient pathways with Portinari
- Protecting privacy in CRN's databases
- Looking back

The free radical analogy of industry-academia collaborations

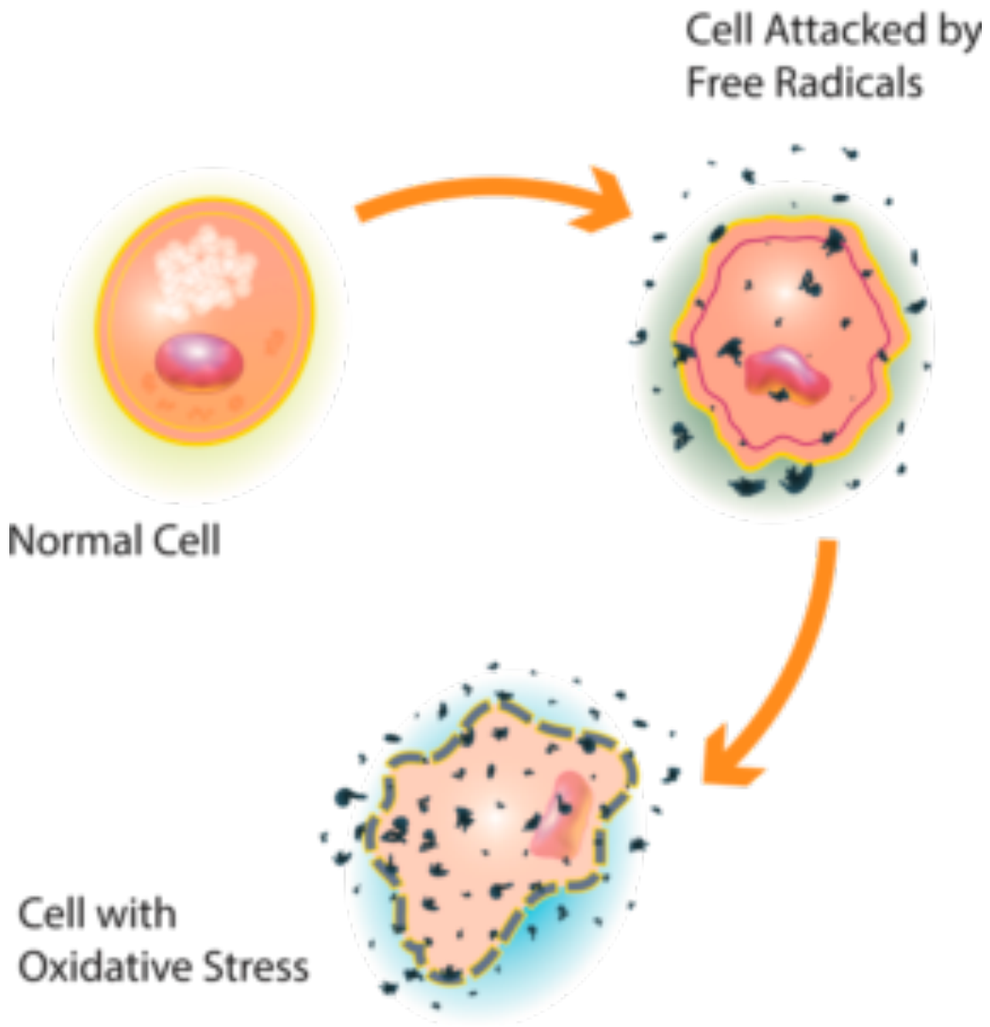
Industry



Researcher

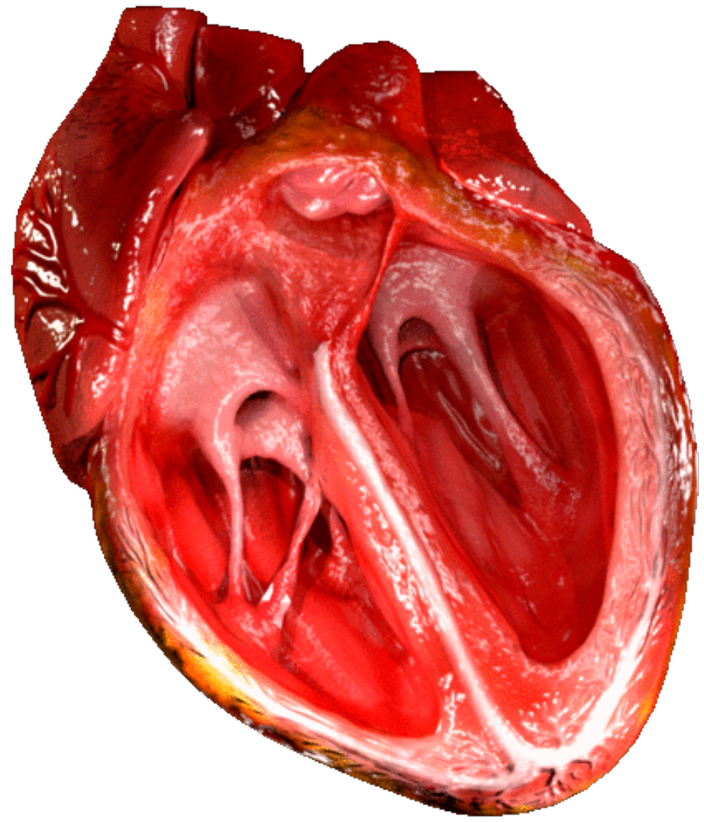


Negative Role



Ageing

Positive Role in Moderation



Pump more blood in stress-filled situations

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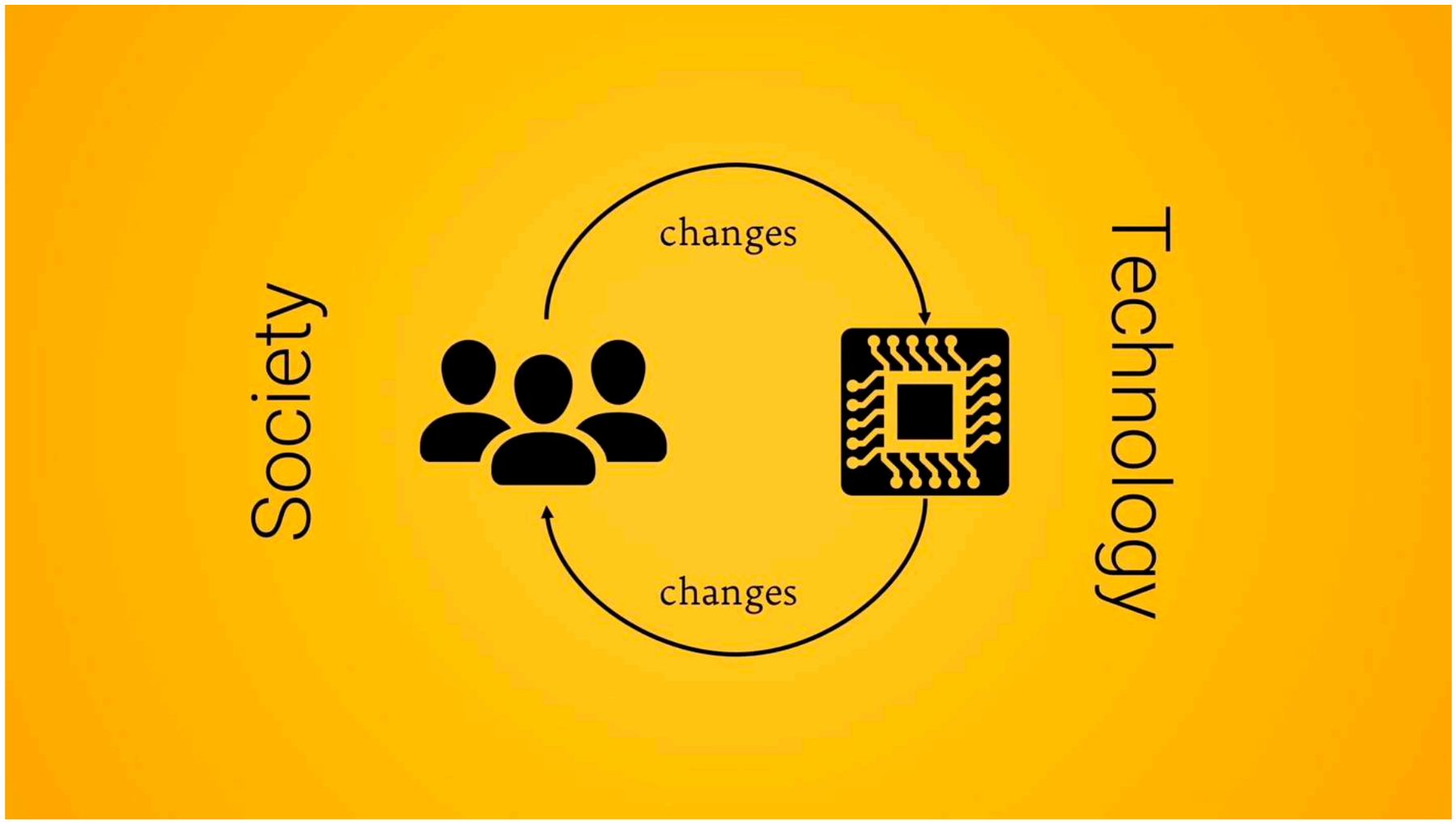
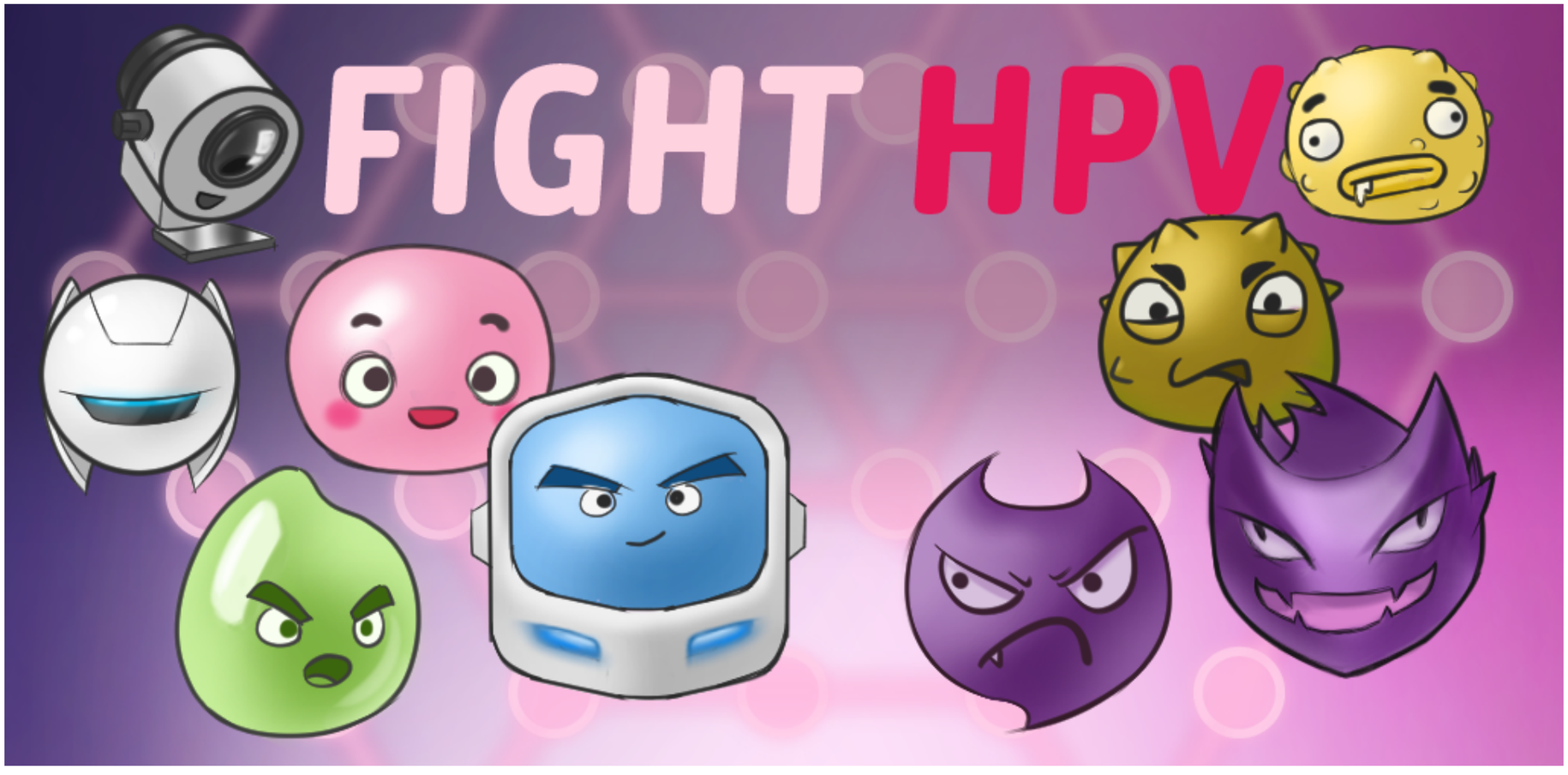
CRN builds socio-technical systems not just data-intensive systems



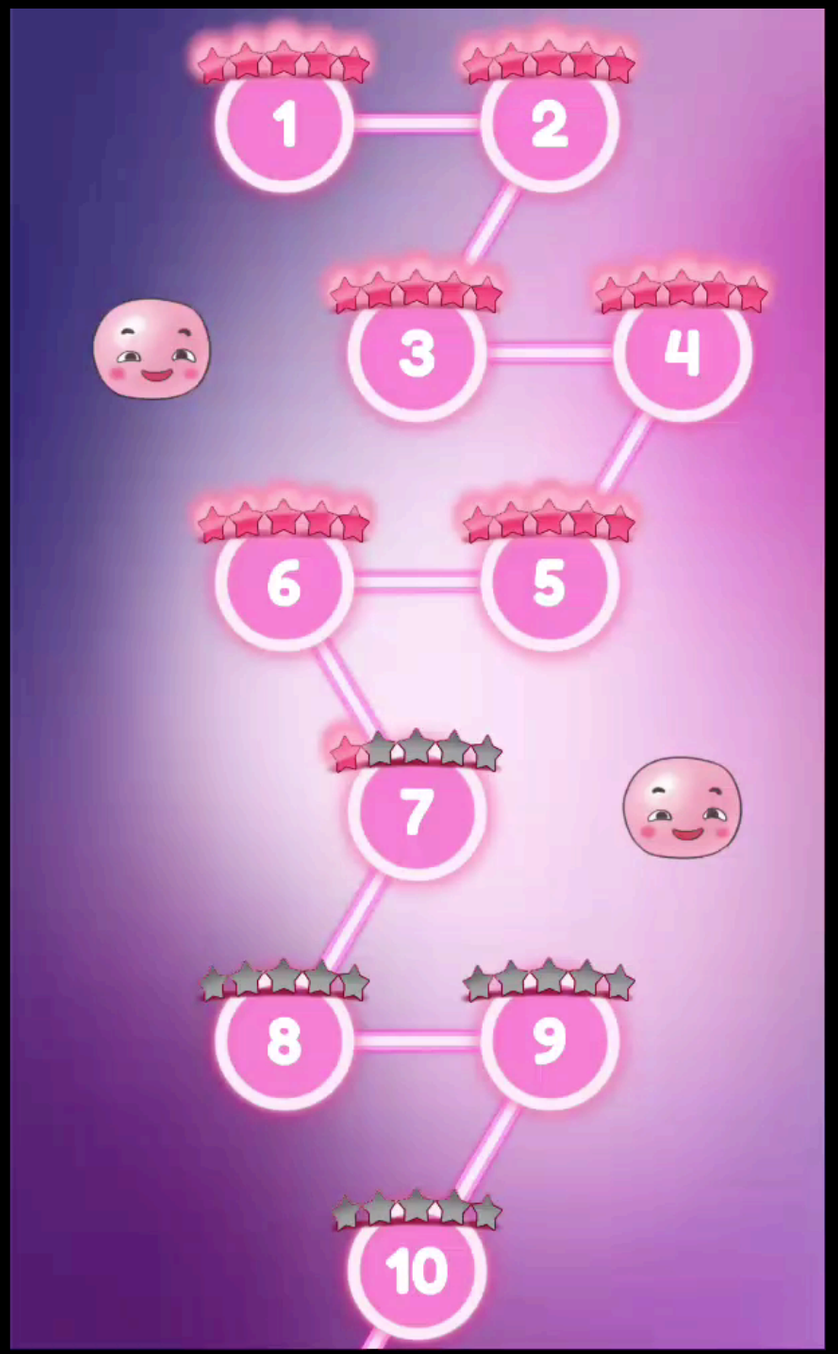
FightHPV
(2015-2019)



Epithel

Episode 1

Epithelial Cells



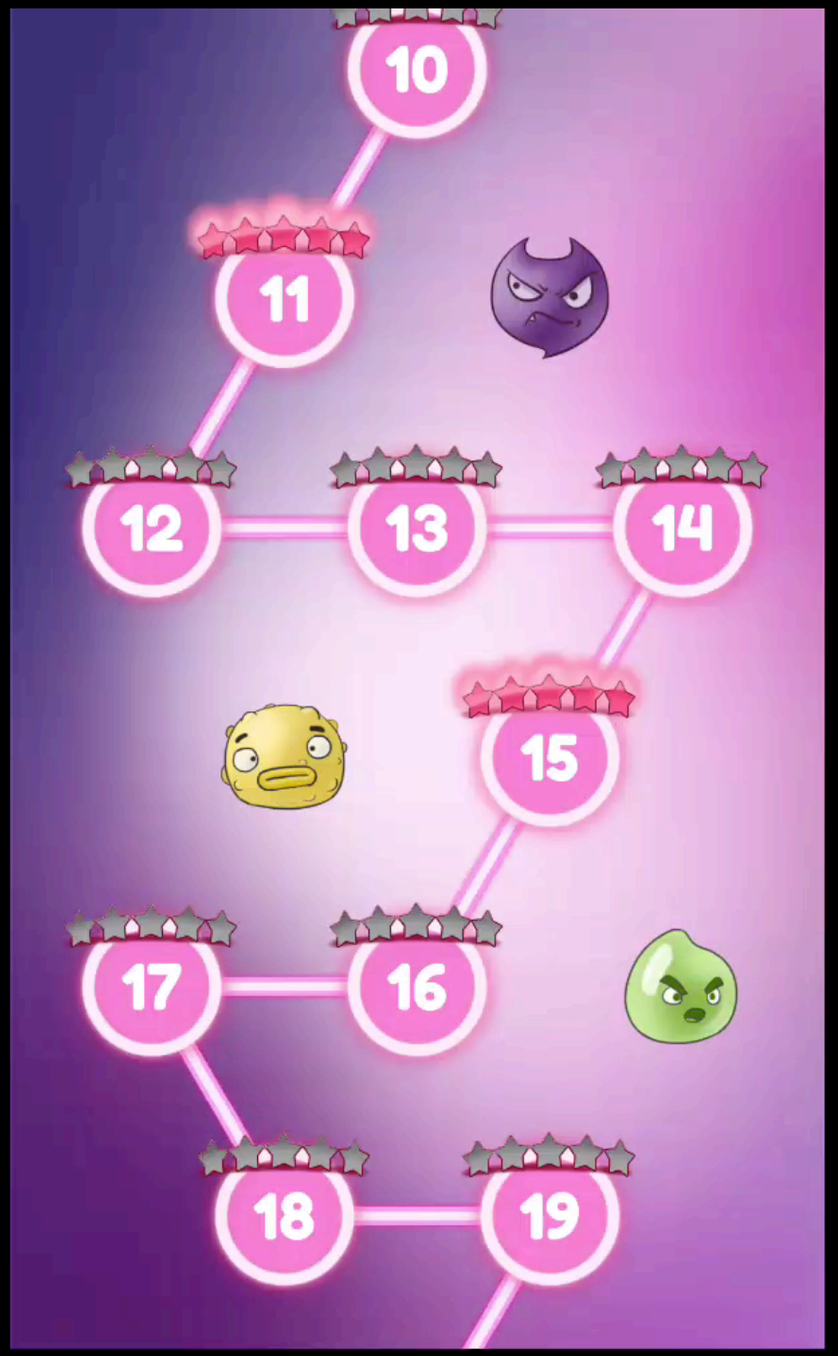
Low-risk HPV

Genital Wart

Imiquimod

Episode 2

Low-risk HPV



Unlocked Achievements

Scorer Pro

Get more than 10.000 points in a level

Scorer

Get a score over 5.000 points in a level

Super quick screening

Collect 3 exfoliated cells with 1 screening

Damage removal

Perform 10 conizations

Leaderboards

Your friends | Public

Top scores

Espen Enerly — 367,577 — 1

Camilla Røvik — 156,293 — 2

Everyware Technologies — 3

Extensive media coverage

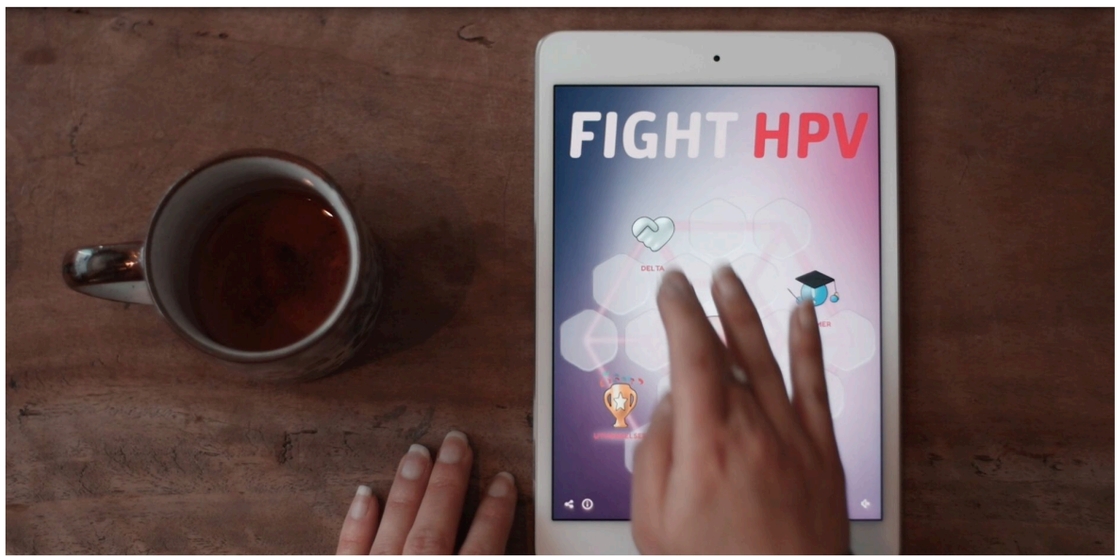
tv2.no/a/9414781/

Mobilspill skal forebygge livmorhalskreft

TV2.no

Bergens Tidende | BT Magasinet | Sport | Kultur | Meninger | Høsttilbud! | Meny

Lokalt



kk | LIVET MITT | MOTE OG SKJØNNHET | HELSE | UNDERHOLDNING | MAMMA | MER | Logg Inn

LIVMORHALSKREFT: – Jeg var heldig. Celleforandring kan oppdages tidlig om du sjekker deg, sier Ingvild Nagell-Dahl. FOTO: Ingunn Helene Kristensen

App mot kreft:

Celleprøve reddet Ingvild fra livmorhalskreft

– Det er først i ettertid at jeg forstår hvor farlig det kunne ha blitt. Og hvor heldig jeg tross alt var, sier sanger og artist Ingvild Nagell-Dahl (46).

Awards

Cancer Registry of Norway

GRAND PRIX

2nd Kreftiregisteret Grandprix

Best poster award at HPV, Cape Town

Did the game have an impact?

Survey in app

Inspiration for others

86 respondents. 70% of the study participants report having learnt quite a lot, 80% of the under-screened women who used the app attended the screening program.

"Guardians of the Cells" by the Cancer Society literally copied FightHPV

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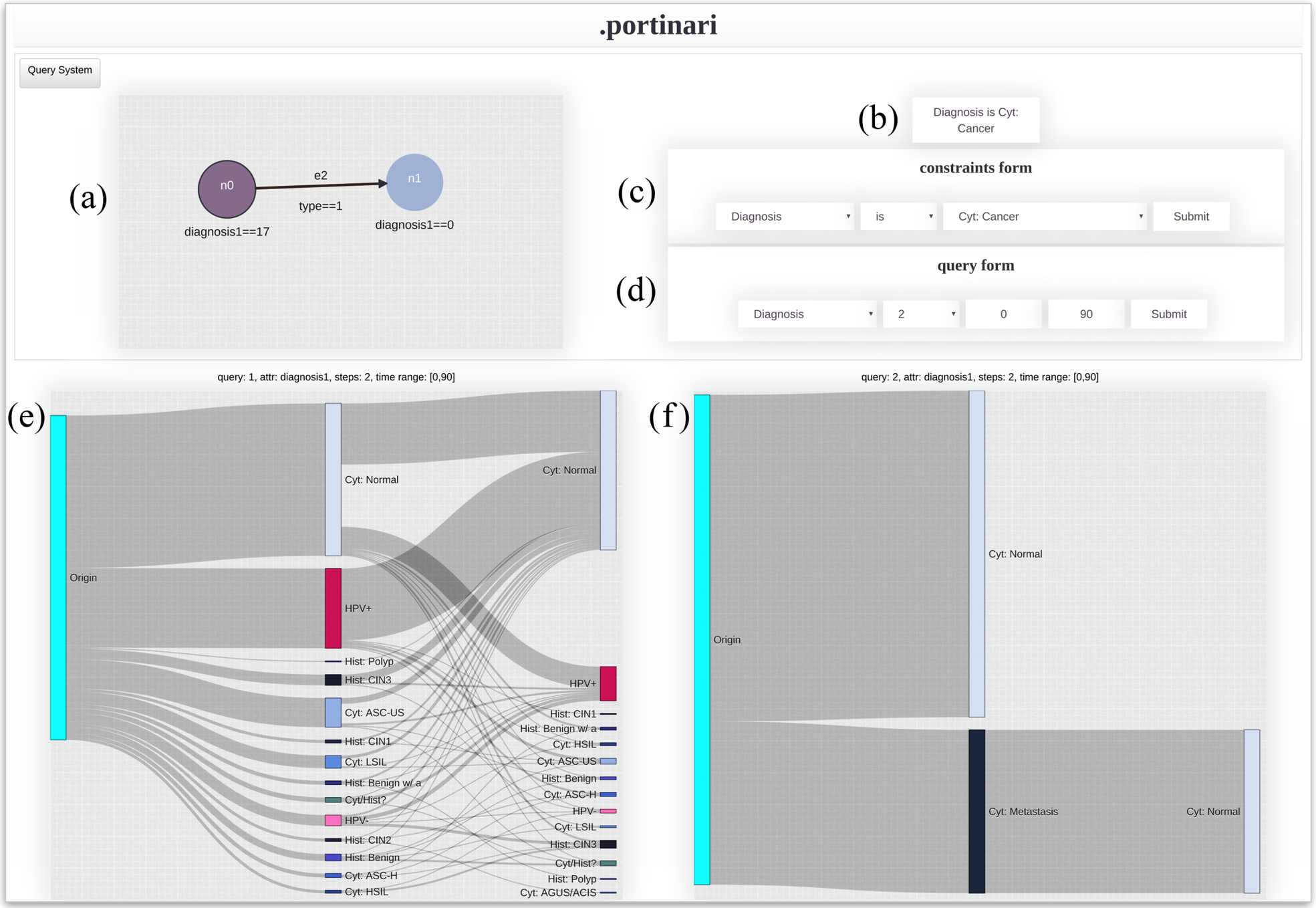
Portinari
(2016-2017)

PORTINARI (2016–2017)

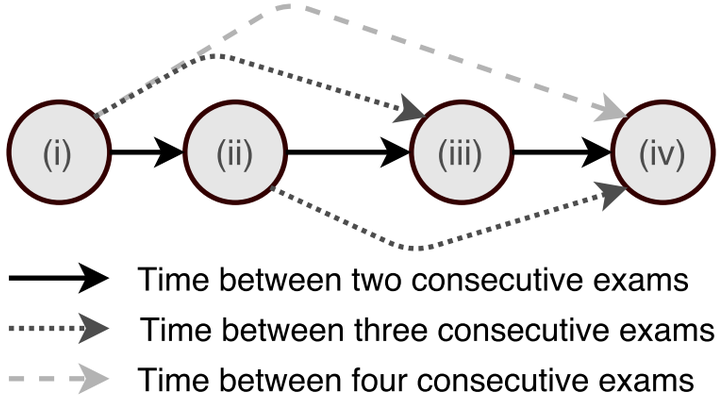


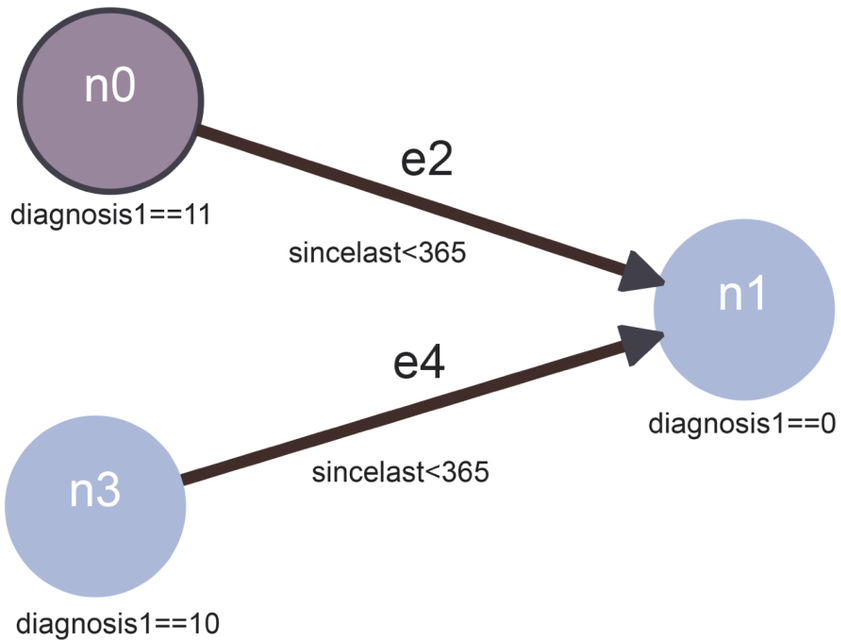
HOW DOES IT WORK? GRAPH DATABASES

Tabular Representation

	ID	Birthdate	Diagnosis Date	Diagnosis Number
(i)	1	08/1960	05/1992	13
(ii)	1	08/1960	09/1992	12
(iii)	1	08/1960	11/1994	20
(iv)	1	08/1960	3/1995	12

Graph Representation

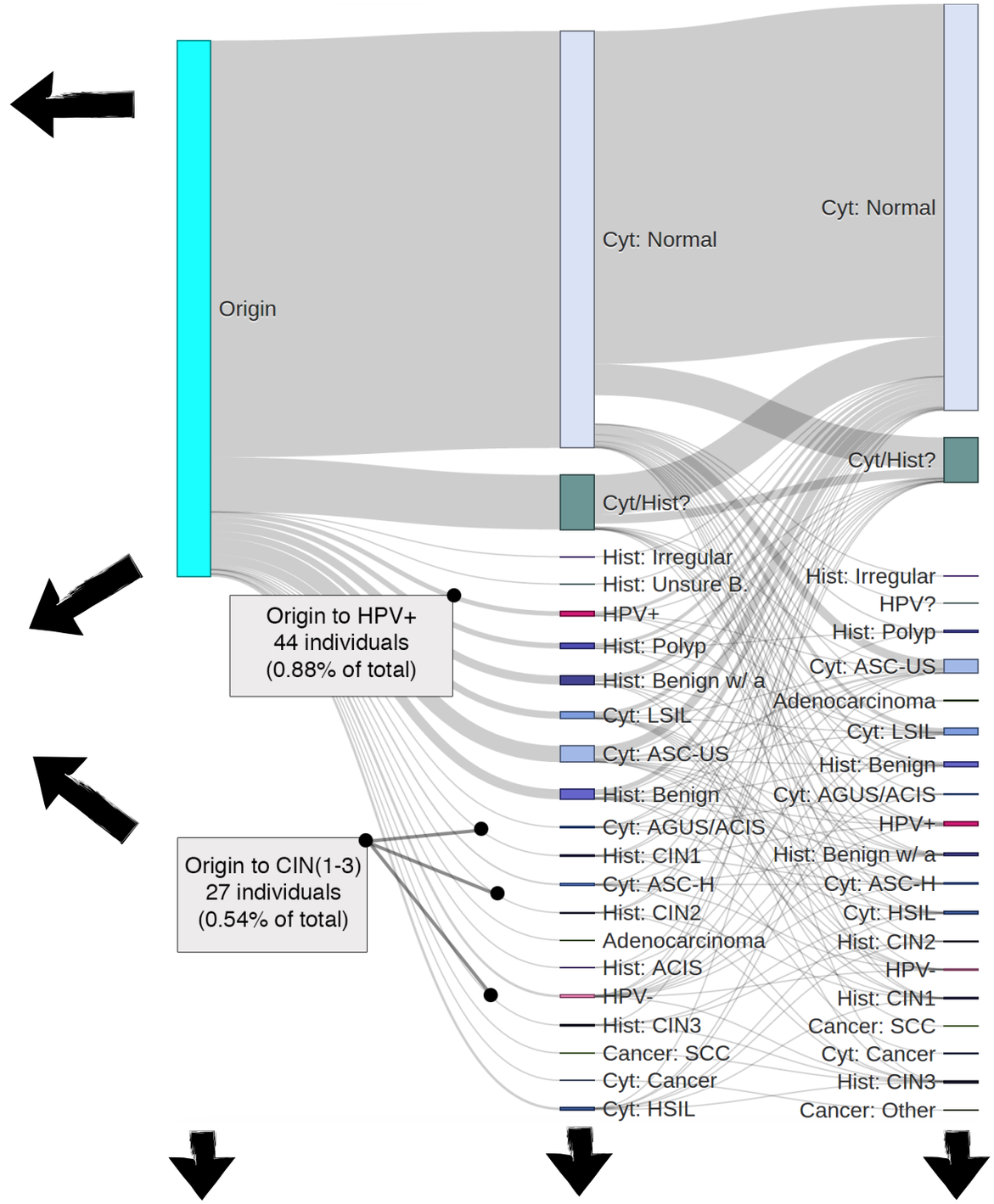





```
MATCH (n0 {diagnosis1 == 11})
MATCH (n1 {diagnosis1 == 0})
MATCH (n3 {diagnosis1 == 10})
MATCH (n0)-[e2]->(n1)
MATCH (n0)-[e2]->(n3)
WHERE e2.sincelast < 365
AND e4.sincelast < 365
```

THE RESULTS

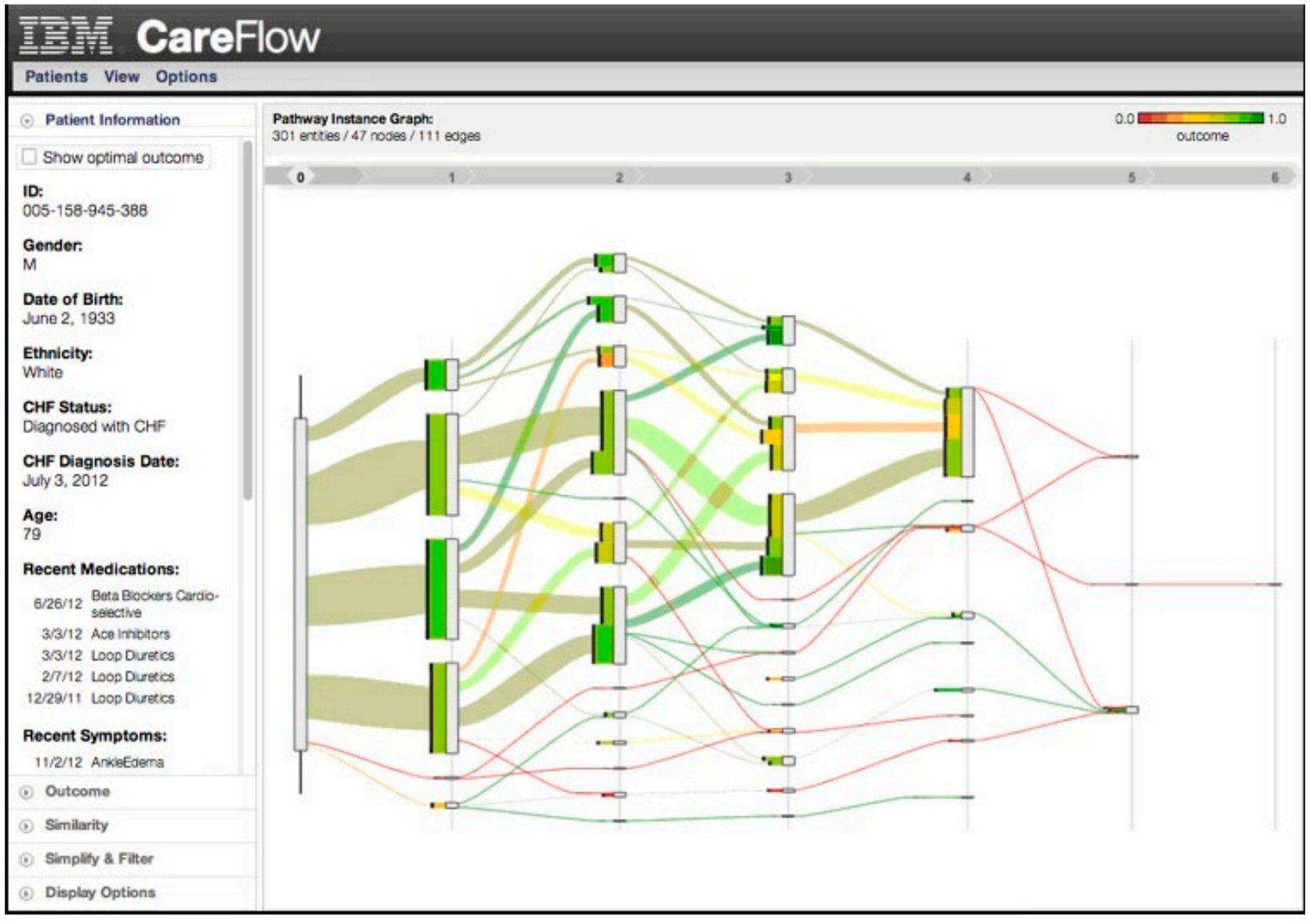
The flow diagram starts where the query ends, showing



Hovering over the edges or nodes of the graph shows stats!

Each layer represents the distribution of diagnosis n exams into the future.

Did the Portinari have an impact?



We accidentally built something that was similar to what IBM is commercialising in their product IBM Careflow

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Privacy at CRN (2017)

Protecting privacy at the Cancer Registry of Norway

Advertisement

Cancer Epidemiology, Biomarkers & Prevention

Research Articles

Protecting Privacy in Large Datasets—First We Assess the Risk; Then We Fuzzy the Data

Giske Ursin, Sagar Sen, Jean-Marie Mottu, and Mari Nygård

DOI: 10.1158/1055-9965.EPI-17-0172 Published August 2017 Check for updates

Collaboration with the chief of CRN, Giske Ursin

Re-identification Risk Analysis

A Realistic dataset

Average prosecutor risk:	97.06733%
Lowest prosecutor risk:	20%
Highest prosecutor risk:	100%
Records affected by lowest risk:	0.00009%
Records affected by highest risk:	94.198%

B All days to 15th of month

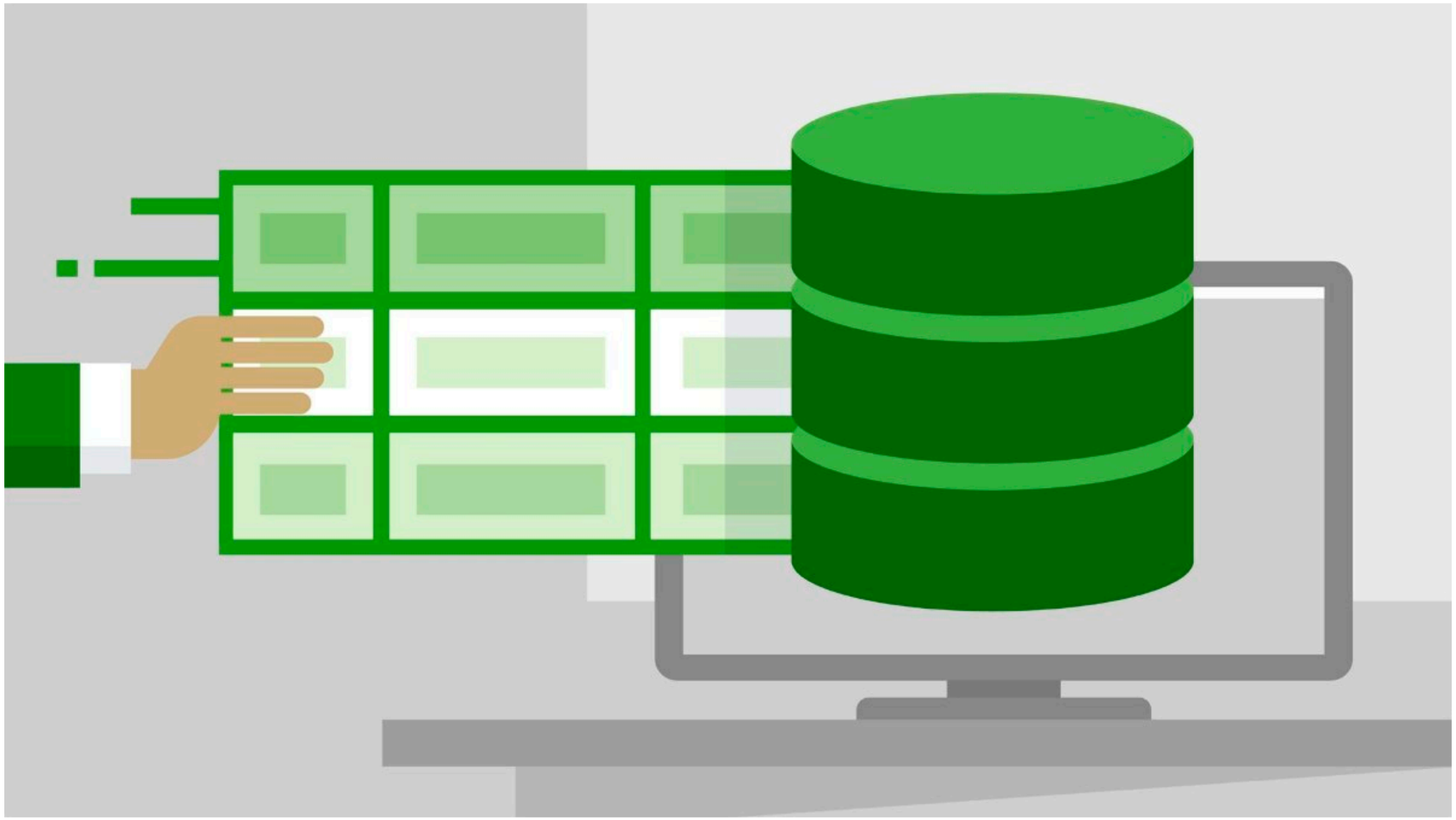
Average prosecutor risk:	9.7%
Lowest prosecutor risk:	1.176%
Highest prosecutor risk:	100%
Records affected by lowest risk:	0.00149%
Records affected by highest risk:	6.0%

C Fuzzy factor ± 4 months

Average prosecutor risk:	9.8%
Lowest prosecutor risk:	1.265%
Highest prosecutor risk:	100%
Records affected by lowest risk:	0.00416%
Records affected by highest risk:	6.1%

Prosecutor risk analysis : intruder has some background knowledge

What is the impact of fuzzing method?



All datasets exported out of CRN is using the fuzzing method developed in the paper.

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2014

Beginning of the collaboration

Sagar's M.Sc. student Soheil joins CRN in Mari Nygård's group and we setup a meeting.

2015

SOIGNONS

The start of the SOIGNONS project and development of FightHPV and Tomas joins the project

2015

MBE-CR

Tao and Shaukat obtain their first grant with CRN

2016

Portinari : Visualization of paths taken by patients

Manoel develops Portinari and we present it ICSE Software Engineering and Society to Lawerence Livermore National Labs.

2017

Awards

Runner-up at Kreftregisteret Grandprix and Best Poster Award at HPV 2017 in Cape Town, South Africa

2018

South Africa

2018

AUGERE AS is established

The networking effort to link Thomas de Lang of CRN to Michael Riegler in 2015 played a role in the creation of Augere

2019

IKTPLUSS projects: SMARTMED & Dechipher

Simula and SimulaMet obtain research council funding on blockchain technologies for medical records and personalized cervical cancer screening

2019

FightHPV Retrospective study

70% of the study participants report having learnt quite a lot, 80% of the under-screened women who used the app attended the screening program.

Are you a free-radical researcher?

- Research must be first and foremost *intrinsically rewarding* but also with *substantial impact*
- We need the *freedom to run experiments*, participate in multiple projects at once, move our ideas forward
- We make stuff and ask research questions often, and often we fail
- We expect to be fully utilized and constantly optimised, regardless of whether we perform research in a small or large organisation
- We believe in the power of creating communities and that networking is sharing